

Space Apps Challenge 2019

NEOSSat: Canada's Space Surveillance Telescope

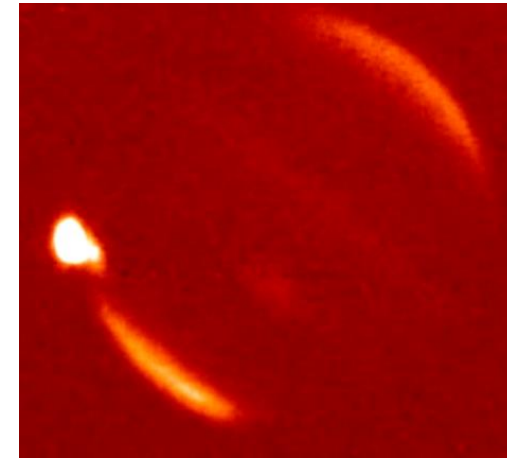
Challenge #2:
Identifying potential asteroids or other objects
within the image archive

Team Pixel Heroes

Parnia Shokri - Amin Zadeh - Bahareh Yekkehkhany

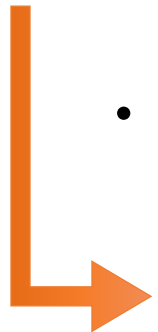
Purpose

- “How Historic Jupiter Comet Impact Led to Planetary Defense”
June 30, 2019 , nasa.gov [1]
- Chemical mixture from which the planets formed some 4.6 billion years ago [2]

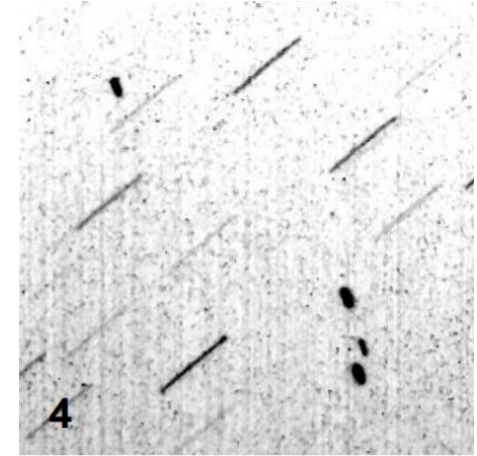


Asteroid/Comet Detection Methods

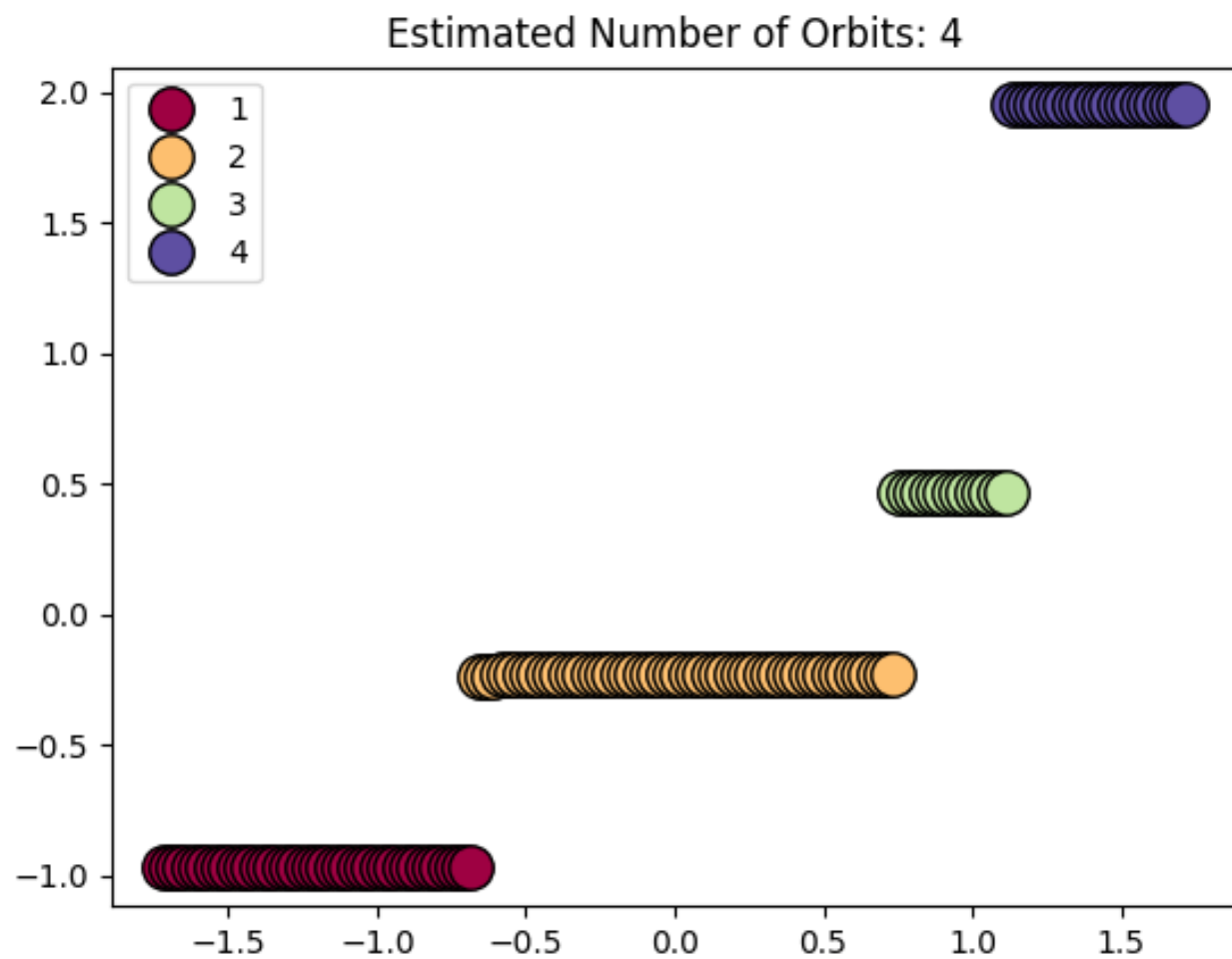
- Blind Search Streak Detection (BSSD) [3]
 - Shift and add [4]
 - computationally intensive process
 - Add
 - generally restricted to linear or mildly curved movement of the target object across the field of view [5]
 - need to be confirmed by a human observer [3]



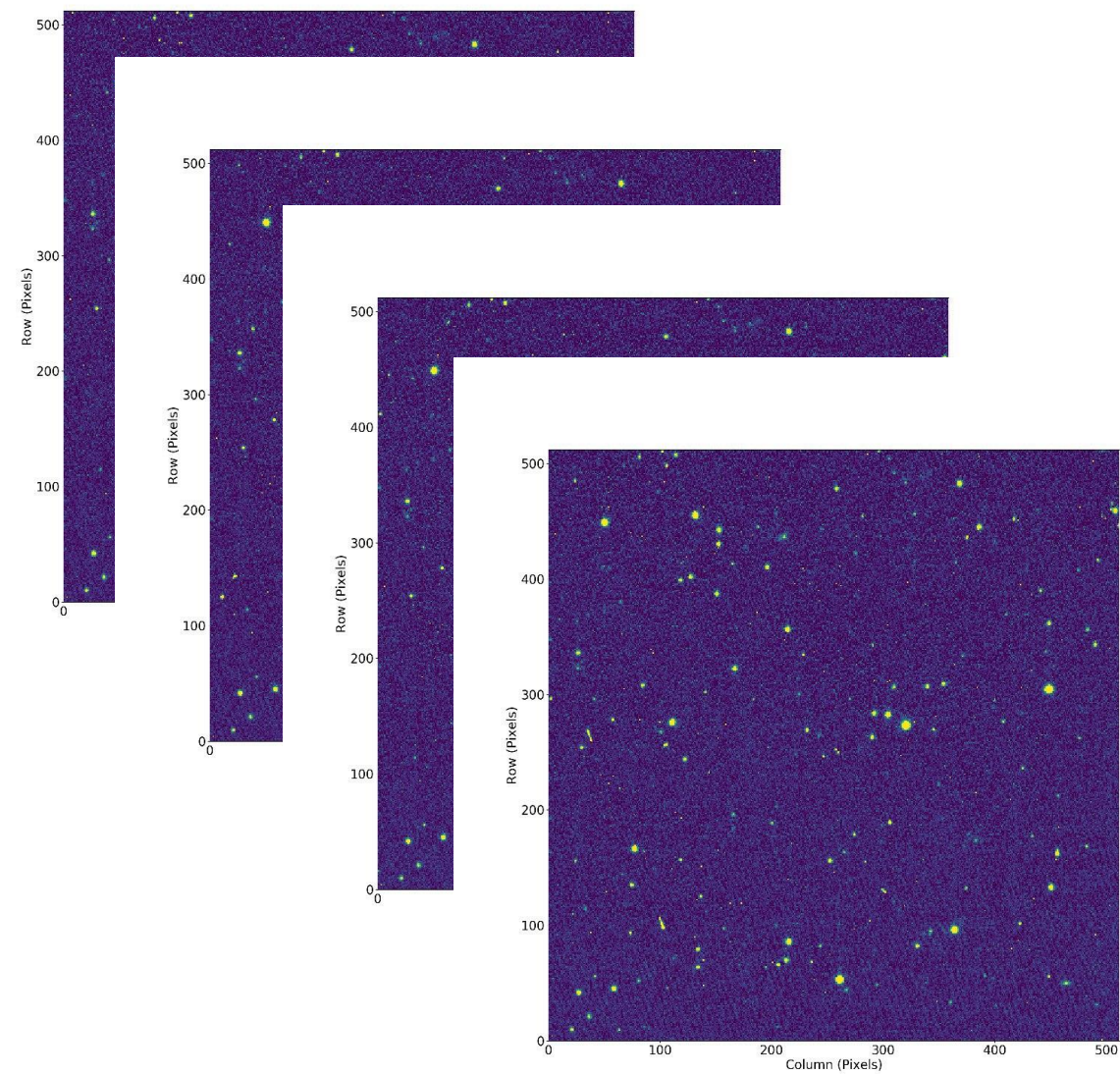
Our focus is on using this method and solving its problems.



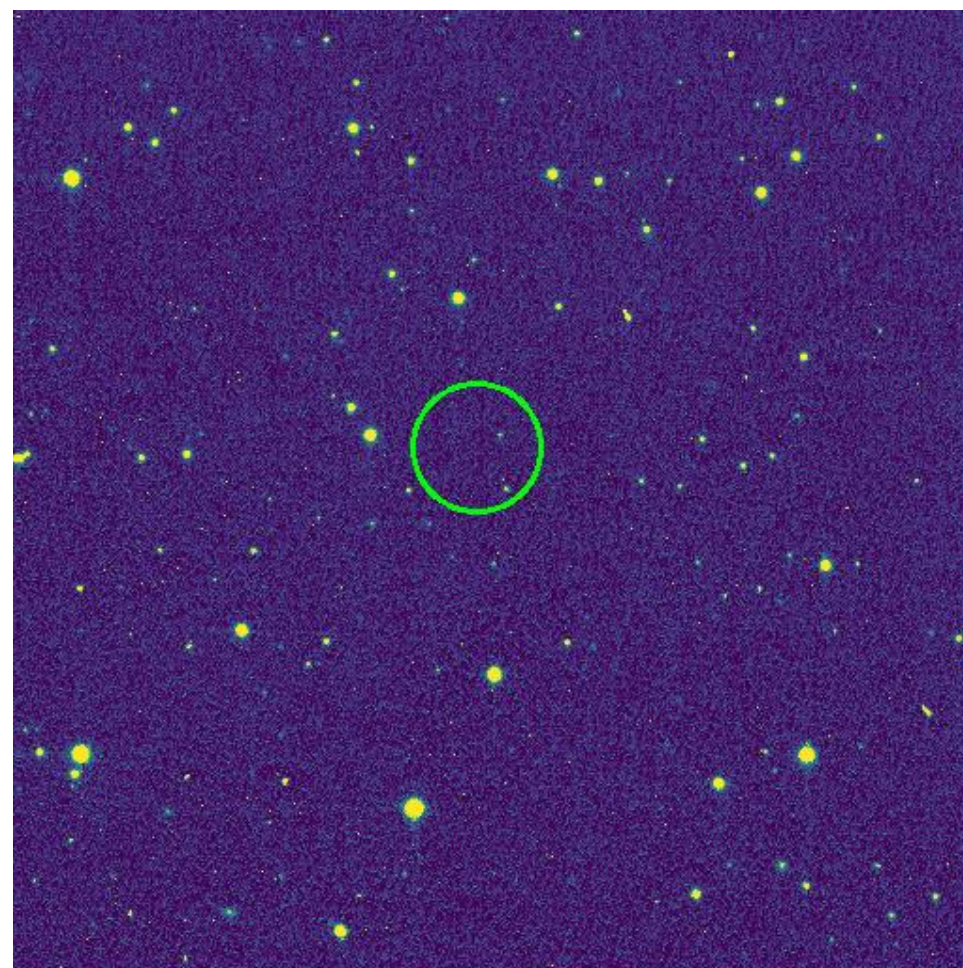
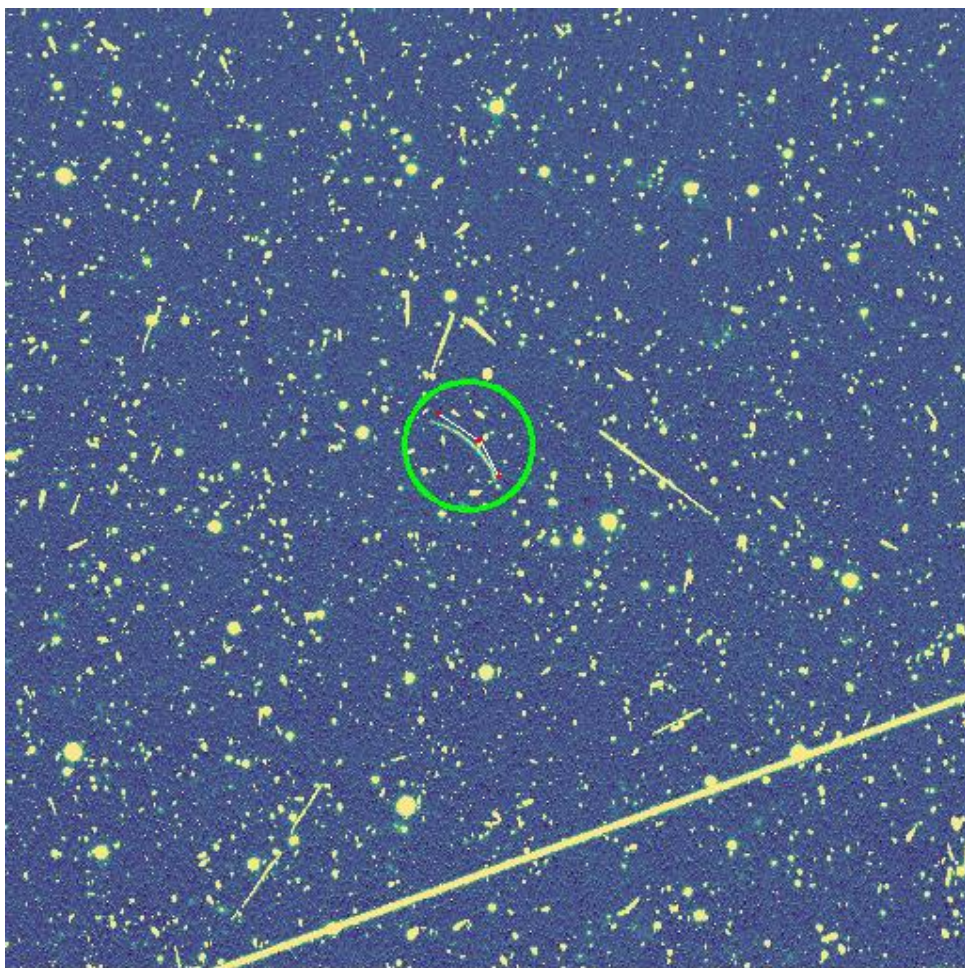
Finding All the Orbits



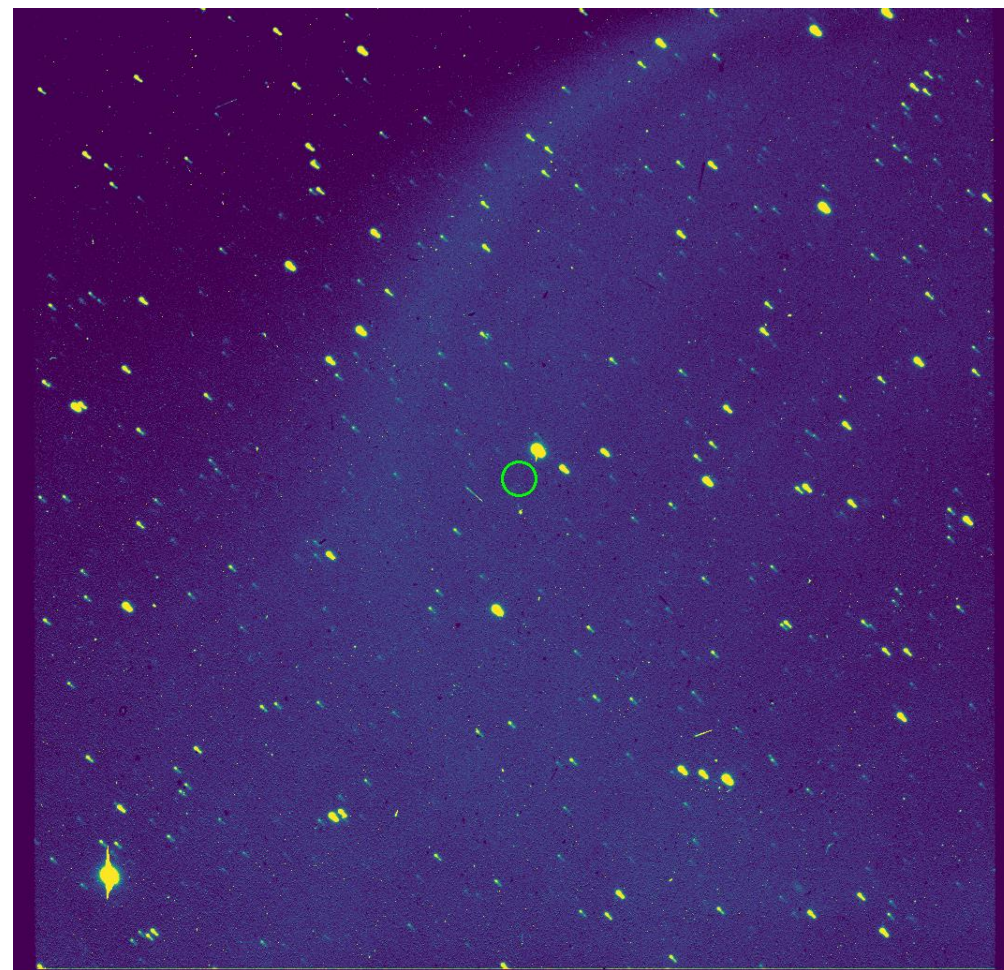
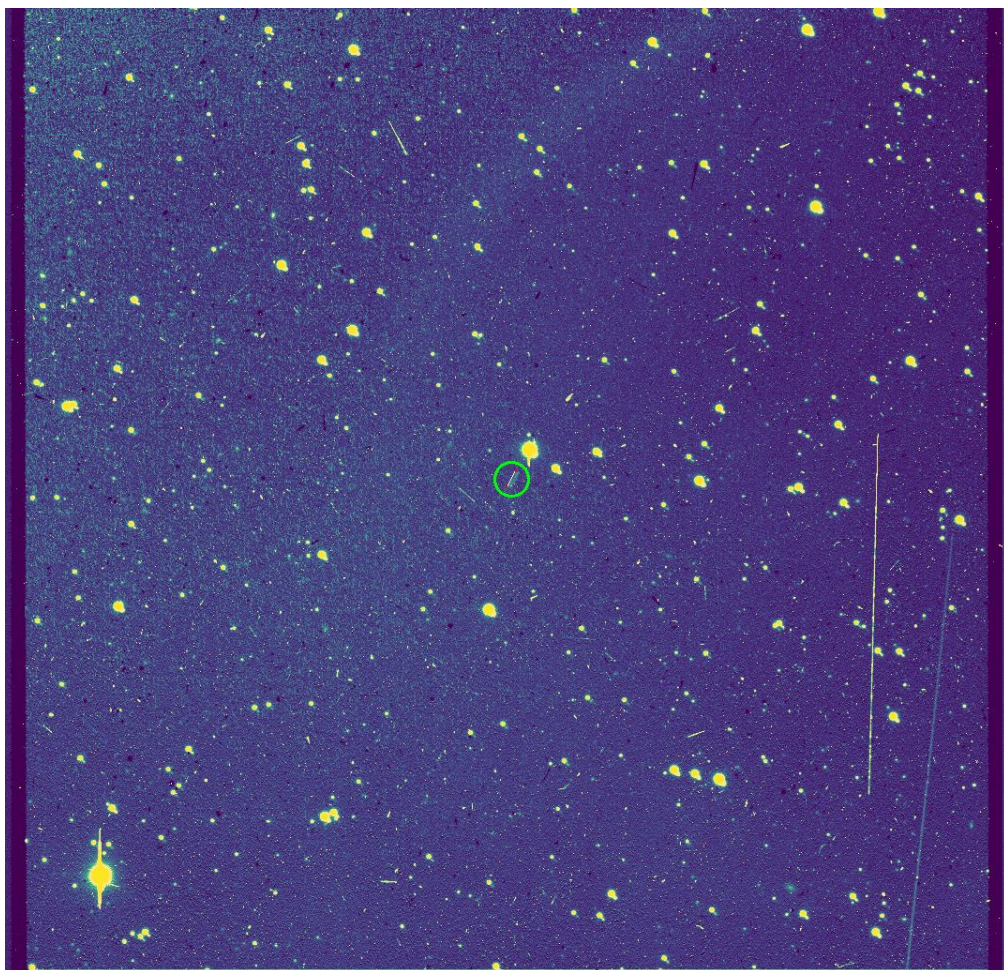
PNG Image Sequence in an Orbit



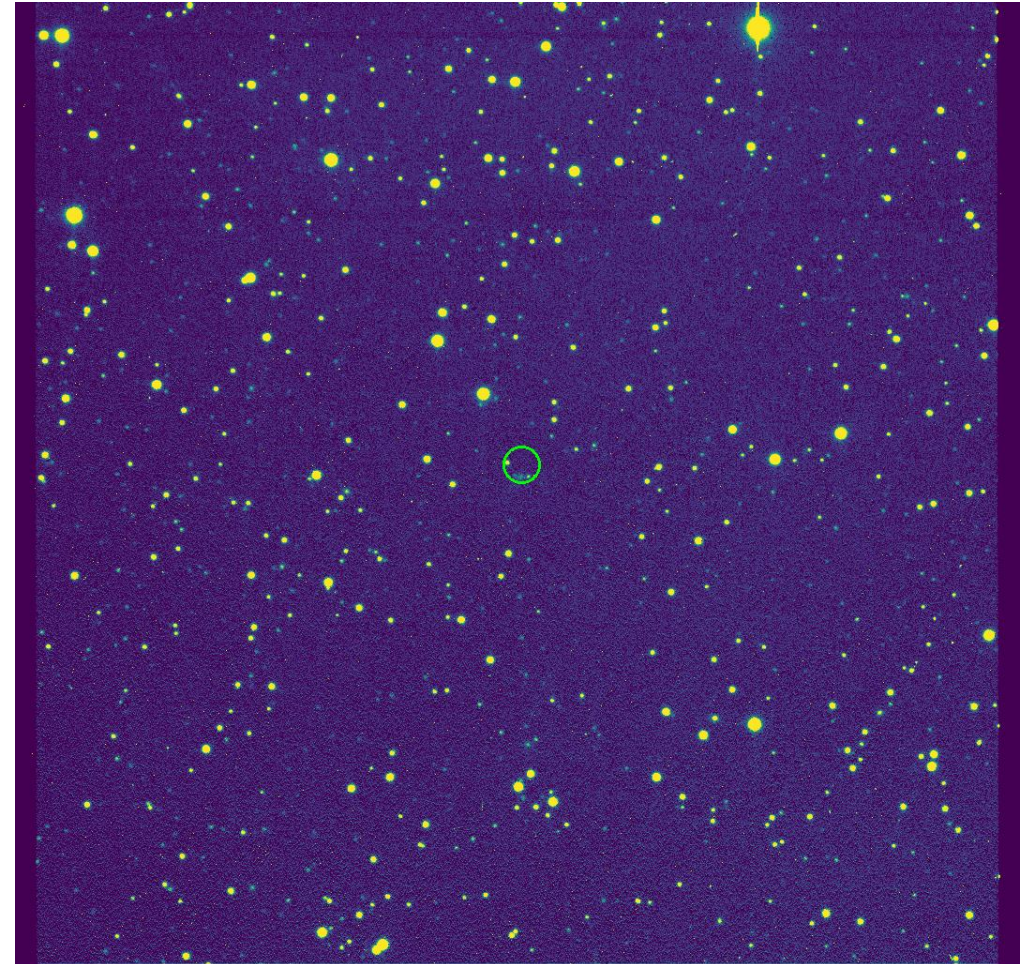
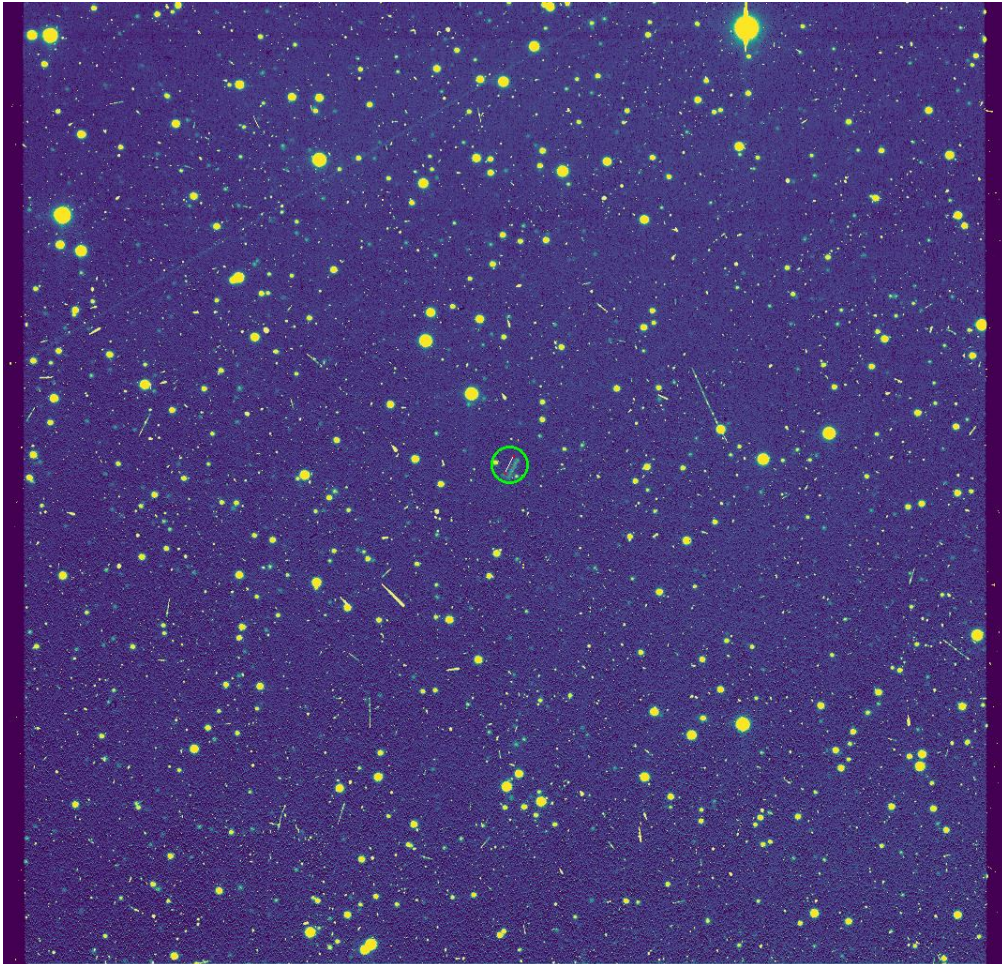
Result: Near-earth Asteroid CK19D010
2019 – 128 – orbit 1



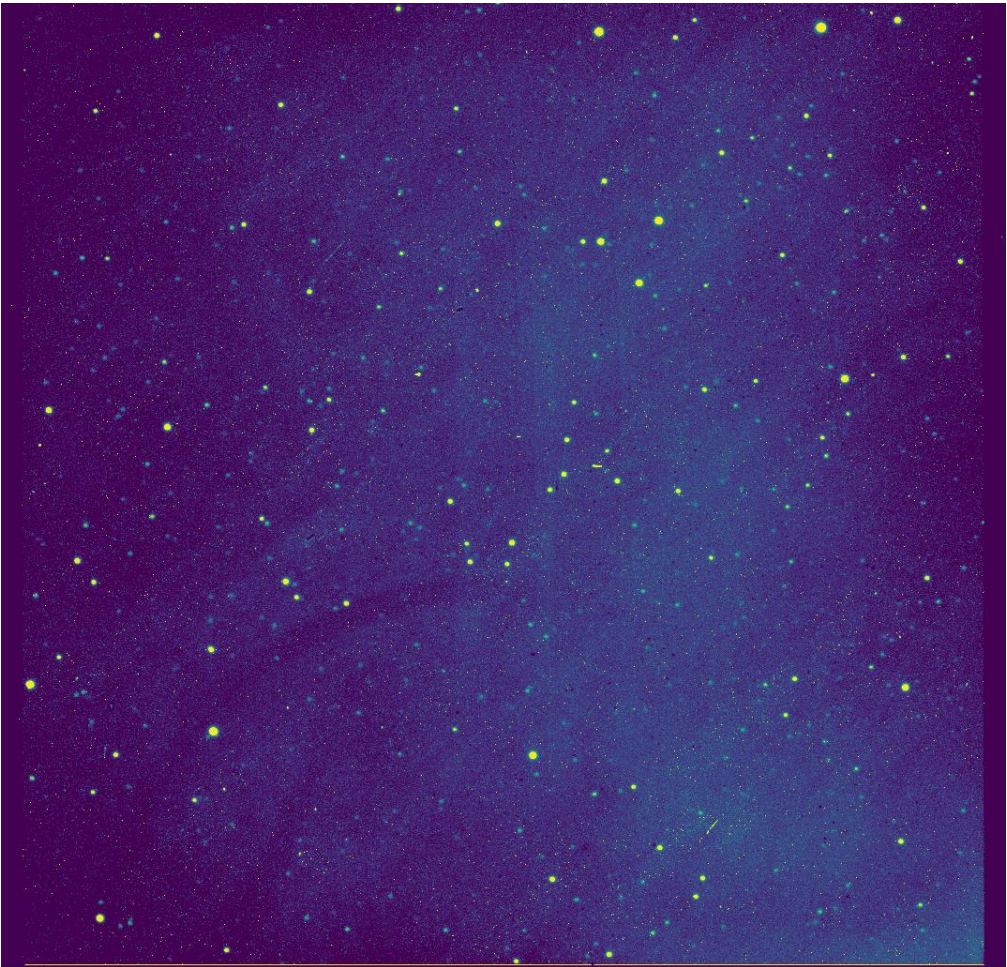
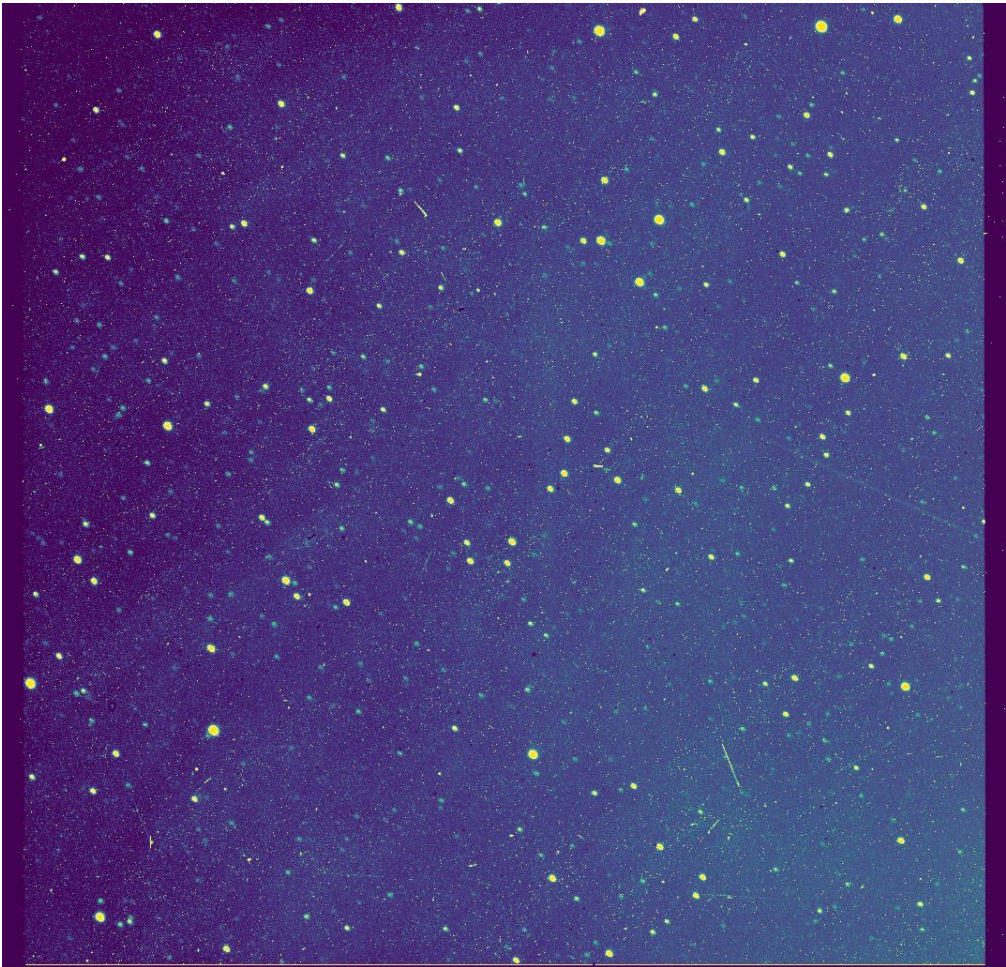
Result: Comet Borisov
2019 – 292 – orbit 4



Result: Comet Borisov
2019 – 306 – orbit 1



Result: 2018/333 – Orbit 1 (No False Positive)



Designed User Interface

Near Earth Object (NEO) Finder

Download Data Set (.FITS):

☐ FTP Address

☐ Day of Year ☒ .fits only

☒ Local

100.0%

Cleaning .FITS Files:

100.0%

Orbit Clustering:

100.0%

	CCD-TEMP	OBJCTRA	OBJCTDEC	OBJCTROL	OBJECT
Value	-34.696	09 59 48.6	14 54 10.6	94.81367	CK19Q040

4

Find Comet/Astroid:

Converting to .png file: 100.0%

Detecting Comets/NEA: 96.0%

Conclusion

- Not restricted to trajectory shape of the moving object across the field of view
- Low number of probable false positives
- User friendly
- Open source

Future Work

- Testing more dataset
- Trying other noise reduction methods to remove probable false positives

References

- [1] <https://www.nasa.gov/feature/goddard/2019/how-historic-jupiter-comet-impact-led-to-planetary-defense>
- [2] <https://cneos.jpl.nasa.gov/about/basics.html>
- [3] Anthony, Niklas, and M. Reza Emami. "Asteroid engineering: The state-of-the-art of Near-Earth Asteroids science and technology." *Progress in Aerospace Sciences* 100 (2018): 1-17.
- [4] Thorsteinson, Stefan. "Key Findings from the NEOSat Space-Based SSA Microsatellite Mission." (2018)
- [5] Gural, Peter S., Paul R. Otto, and Edward F. Tedesco. "Moving object detection using a parallax shift vector algorithm." *Publications of the Astronomical Society of the Pacific* 130, no. 989 (2018): 074504

Thank you

